

BLF647P

Broadband power LDMOS transistor

Rev. 2 — 12 April 2013

Product data sheet

1. Product profile

1.1 General description

A 200 W LDMOS RF power transistor for broadcast transmitter and industrial applications. The transistor is suitable for the frequency range HF to 1500 MHz. The excellent ruggedness and broadband performance of this device makes it ideal for digital applications.

Table 1. Application information

RF performance at $T_h = 25\text{ °C}$ in a common source test circuit.

Test signal	f (MHz)	V _{DS} (V)	I _{Dq} (A)	P _{L(AV)} (W)	P _{L(M)} (W)	G _p (dB)	η _D (%)	IMD3 (dBc)
Pulsed, class-B	1300	32	0.1	-	200	18	70	-
CW, class-B	1300	32	0.1	200	-	18	70	-
2-tone, class-AB	f ₁ = 1299.95; f ₂ = 1300.05	32	0.7	75	-	19	48	-33

1.2 Features and benefits

- Integrated ESD protection
- Excellent ruggedness
- High power gain
- High efficiency
- Excellent reliability
- Easy power control
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

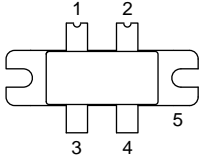
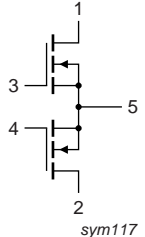
1.3 Applications

- Communication transmitter applications in the HF to 1500 MHz frequency range
- Industrial applications in the HF to 1500 MHz frequency range



2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	drain1		 sym117
2	drain2		
3	gate1		
4	gate2		
5	source		

[1] Connected to flange

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLF647P	-	flanged LDMOST ceramic package; 2 mounting holes; 4 leads	SOT1121A

4. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage		-	65	V
V_{GS}	gate-source voltage		-0.5	+11	V
T_{stg}	storage temperature		-65	+150	°C
T_j	junction temperature	[1]	-	225	°C

[1] Continuous use at maximum temperature will affect the reliability. For details refer to the on-line MTF calculator.

5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	$T_{case} = 80\text{ °C}; P_L = 200\text{ W}$	[1]	0.34 K/W

[1] $R_{th(j-c)}$ is measured under RF conditions.

6. Characteristics

Table 6. DC characteristics

$T_j = 25\text{ }^\circ\text{C}$; per section unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0\text{ V}$; $I_D = 1.1\text{ mA}$	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 28\text{ V}$; $I_D = 110\text{ mA}$	1.55	1.8	2.25	V
I_{DSS}	drain leakage current	$V_{GS} = 0\text{ V}$; $V_{DS} = 28\text{ V}$	-	-	1.4	μA
I_{DSX}	drain cut-off current	$V_{GS} = V_{GS(th)} + 3.75\text{ V}$; $V_{DS} = 20\text{ V}$	18.1	20	-	A
I_{GSS}	gate leakage current	$V_{GS} = 11\text{ V}$; $V_{DS} = 0\text{ V}$	-	-	140	nA
g_{fs}	forward transconductance	$V_{DS} = 20\text{ V}$; $I_D = 5500\text{ mA}$	-	7.6	-	S
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 3.75\text{ V}$; $I_D = 3.85\text{ A}$	-	140	-	$\text{m}\Omega$

Table 7. AC characteristics

$T_j = 25\text{ }^\circ\text{C}$; per section unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_{iss}	input capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 32\text{ V}$; $f = 1\text{ MHz}$	-	78	-	pF
C_{oss}	output capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 32\text{ V}$; $f = 1\text{ MHz}$	-	30	-	pF
C_{rs}	feedback capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 32\text{ V}$; $f = 1\text{ MHz}$	-	1.3	-	pF

Table 8. RF characteristics

Test signal: CW; $f = 1300\text{ MHz}$; RF performance at $V_{DS} = 32\text{ V}$; $I_{Dq} = 100\text{ mA}$; $T_{case} = 25\text{ }^\circ\text{C}$; unless otherwise specified; in a class-AB production test circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
G_p	power gain	$P_L = 200\text{ W}$	17	18	-	dB
η_D	drain efficiency	$P_L = 200\text{ W}$	66	70	-	%

7. Test information

7.1 Ruggedness in class-AB operation

The BLF647P is capable of withstanding a load mismatch corresponding to $VSWR = 10 : 1$ through all phases under the following conditions: $V_{DS} = 32\text{ V}$; $f = 1300\text{ MHz}$ at rated load power.

7.2 Test circuit information

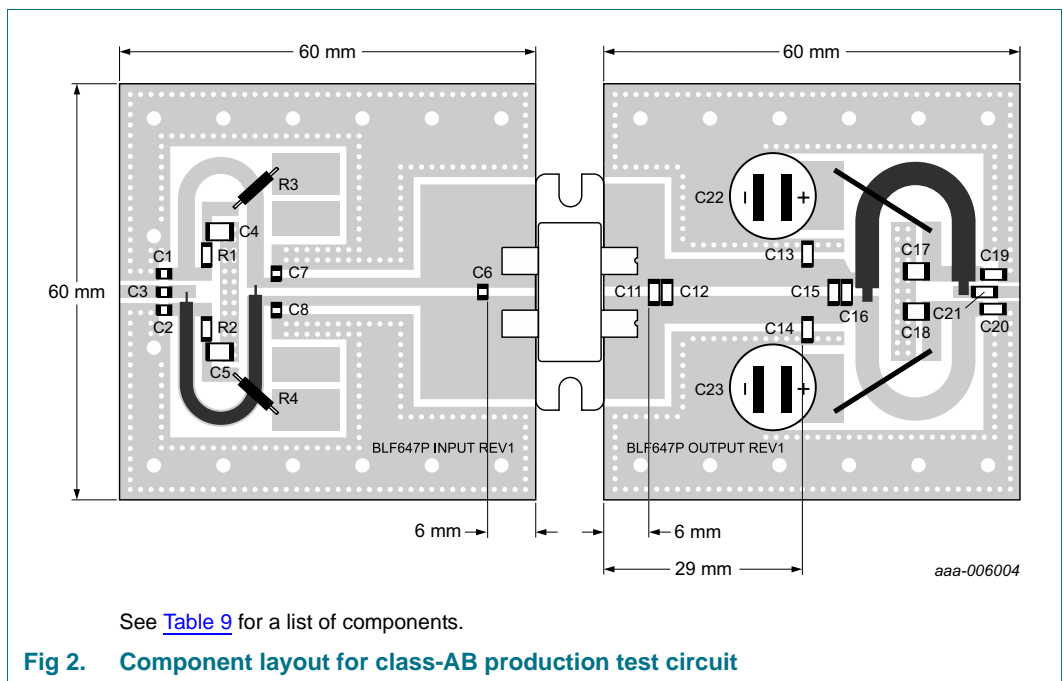
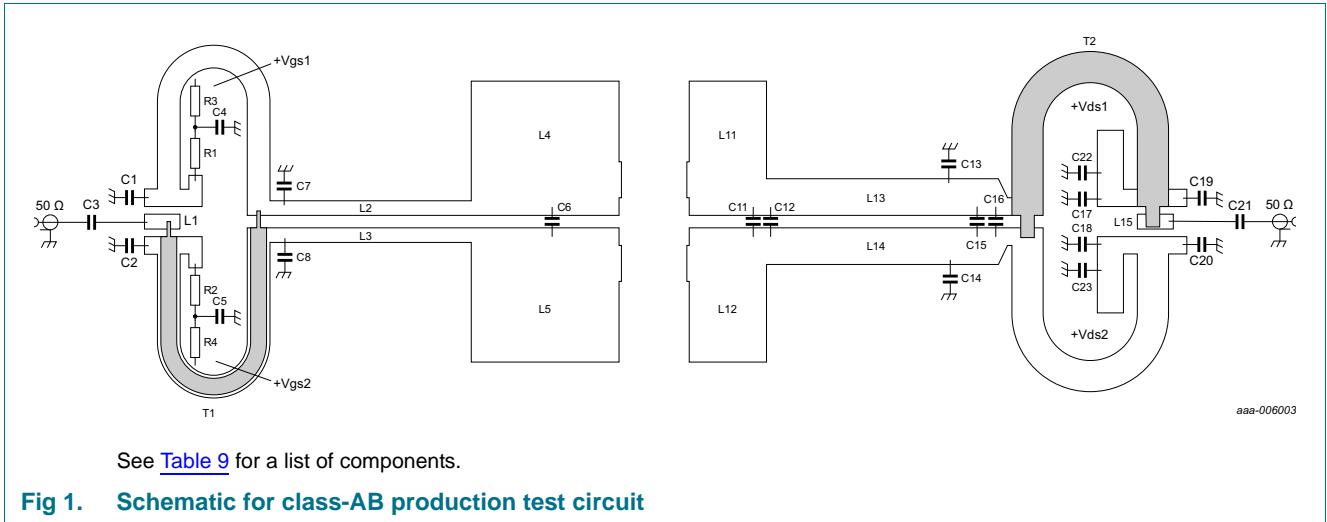


Table 9. List of components

Printed-Circuit Board (PCB): RF 35; $\epsilon_r = 3.5$ F/m; thickness = 0.765 mm; thickness copper plating = 35 μ m.
See [Figure 1](#) and [Figure 2](#).

Component	Description	Value	Remarks
C1, C2, C3	multilayer ceramic chip capacitor	68 pF	[1]
C4, C5	multilayer ceramic chip capacitor	4.7 μ F, 50 V	
C6	multilayer ceramic chip capacitor	2.4 pF	[2]
C7, C8	multilayer ceramic chip capacitor	4.7 pF	[1]
C11	multilayer ceramic chip capacitor	3.3 pF	[3]
C12	multilayer ceramic chip capacitor	2.4 pF	[3]
C13, C14	multilayer ceramic chip capacitor	3.3 pF	[3]
C15, C16	multilayer ceramic chip capacitor	1.2 pF	[3]
C17, C18	multilayer ceramic chip capacitor	4.7 μ F, 50 V	
C19, C20, C21	multilayer ceramic chip capacitor	220 pF	[3]
C22, C23	electrolytic capacitor	470 μ F, 63 V	
L1	microstrip		(L \times W) 4 mm \times 1.7 mm
L2, L3	microstrip		(L \times W) 22.5 mm \times 1.6 mm
L4, L5	microstrip		(L \times W) 16.5 mm \times 15 mm
L11, L12	microstrip		(L \times W) 8.5 mm \times 15 mm
L13, L14	microstrip		(L \times W) 26 mm \times 4.2 mm
L15	microstrip		(L \times W) 4 mm \times 1.7 mm
R1, R2	SMD resistor	5.6 Ω	SMD1206
R3, R4	WIRE resistor	100 Ω	
T1	semi rigid coax	25 Ω , 40 mm	UT-090C-25
T2	semi rigid coax	25 Ω , 40 mm	UT-141C-25

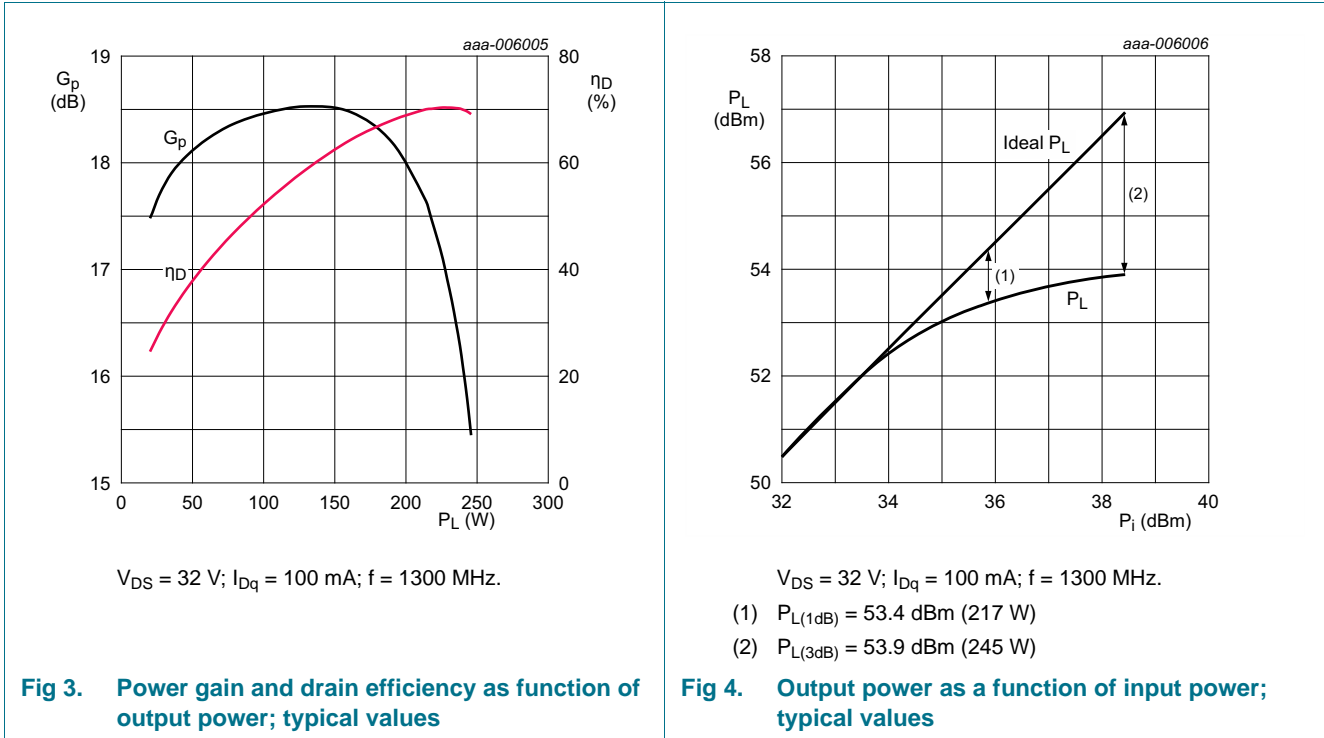
[1] American Technical Ceramics type 800A or capacitor of same quality.

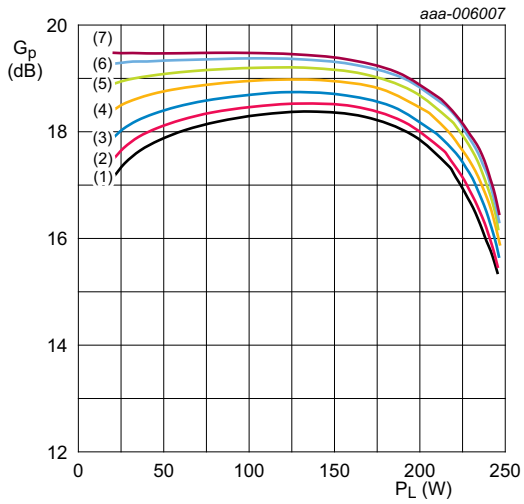
[2] American Technical Ceramics type 100A or capacitor of same quality.

[3] American Technical Ceramics type 800B or capacitor of same quality.

7.3 Graphical data

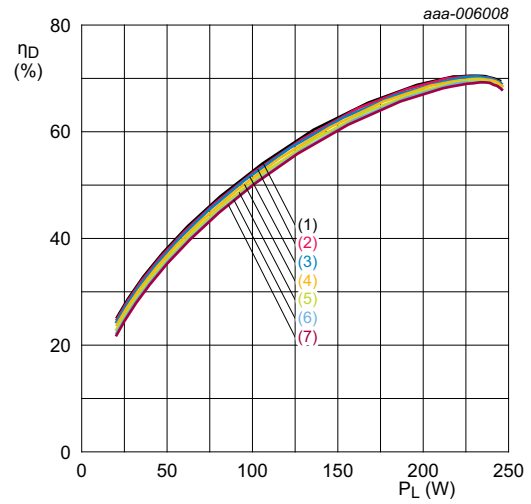
7.3.1 1-Tone CW





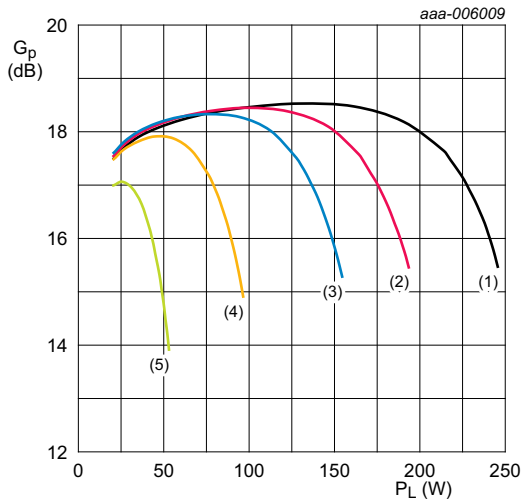
- $V_{DS} = 32\text{ V}; f = 1300\text{ MHz.}$
- (1) $I_{Dq} = 50\text{ mA}$
 - (2) $I_{Dq} = 100\text{ mA}$
 - (3) $I_{Dq} = 200\text{ mA}$
 - (4) $I_{Dq} = 300\text{ mA}$
 - (5) $I_{Dq} = 700\text{ mA}$
 - (6) $I_{Dq} = 1000\text{ mA}$
 - (7) $I_{Dq} = 1200\text{ mA}$

Fig 5. Power gain as a function of output power; typical values



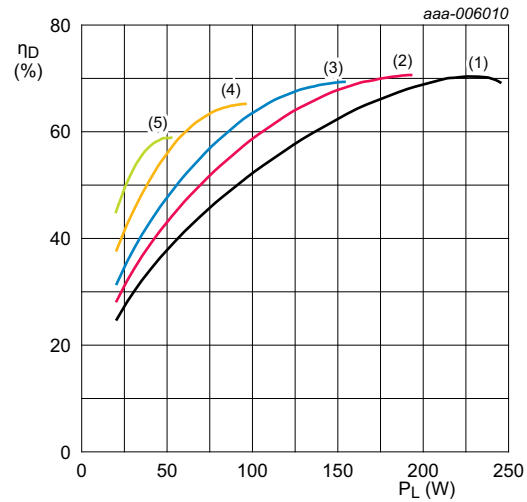
- $V_{DS} = 32\text{ V}; f = 1300\text{ MHz.}$
- (1) $I_{Dq} = 50\text{ mA}$
 - (2) $I_{Dq} = 100\text{ mA}$
 - (3) $I_{Dq} = 200\text{ mA}$
 - (4) $I_{Dq} = 300\text{ mA}$
 - (5) $I_{Dq} = 700\text{ mA}$
 - (6) $I_{Dq} = 1000\text{ mA}$
 - (7) $I_{Dq} = 1200\text{ mA}$

Fig 6. Drain efficiency as a function of output power; typical values



- $I_{Dq} = 100 \text{ mA}$; $f = 1300 \text{ MHz}$.
- (1) $V_{DS} = 32 \text{ V}$
 - (2) $V_{DS} = 28 \text{ V}$
 - (3) $V_{DS} = 25 \text{ V}$
 - (4) $V_{DS} = 20 \text{ V}$
 - (5) $V_{DS} = 15 \text{ V}$

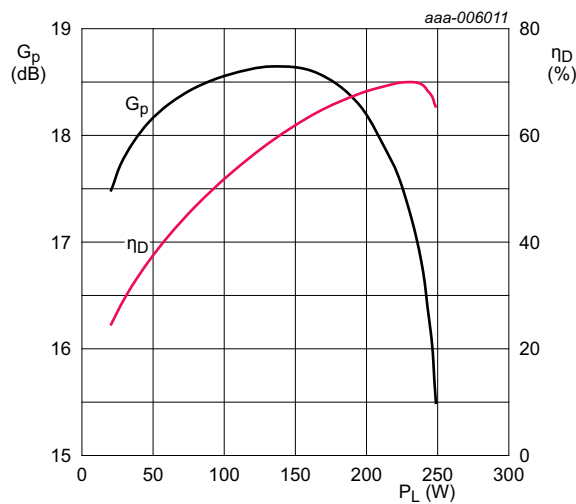
Fig 7. Power gain as a function of output power; typical values



- $I_{Dq} = 100 \text{ mA}$; $f = 1300 \text{ MHz}$.
- (1) $V_{DS} = 32 \text{ V}$
 - (2) $V_{DS} = 28 \text{ V}$
 - (3) $V_{DS} = 25 \text{ V}$
 - (4) $V_{DS} = 20 \text{ V}$
 - (5) $V_{DS} = 15 \text{ V}$

Fig 8. Drain efficiency as a function of output power; typical values

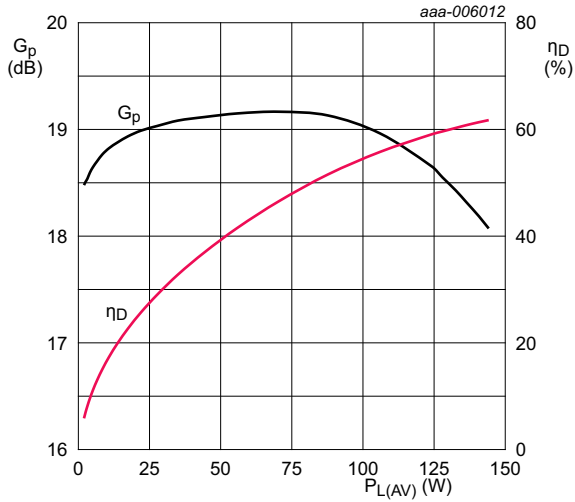
7.3.2 1-Tone pulsed



$V_{DS} = 32 \text{ V}$; $I_{Dq} = 100 \text{ mA}$; $f = 1300 \text{ MHz}$; $t_p = 100 \mu\text{s}$; $\delta = 20\%$.

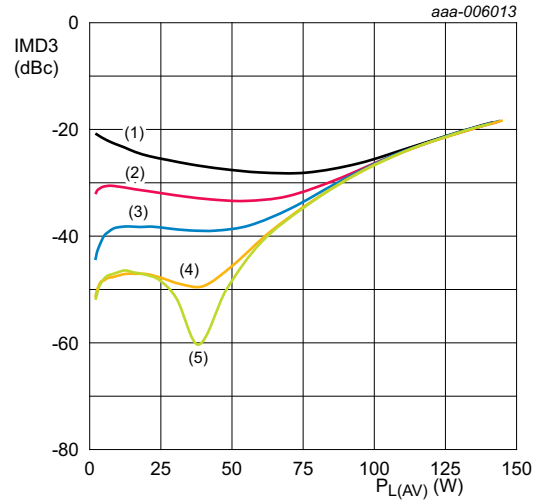
Fig 9. Power gain and drain efficiency as function of output power; typical values

7.3.3 2-Tone CW



$V_{DS} = 50$ V; $I_{Dq} = 700$ mA; $f_1 = 1299.95$ MHz; $f_2 = 1300.05$ MHz.

Fig 10. Power gain and drain efficiency as function of average output power; typical values



$V_{DS} = 32$ V; $f_1 = 1299.95$ MHz; $f_2 = 1300.05$ MHz.

- (1) $I_{Dq} = 100$ mA
- (2) $I_{Dq} = 400$ mA
- (3) $I_{Dq} = 700$ mA
- (4) $I_{Dq} = 1000$ mA
- (5) $I_{Dq} = 1200$ mA

Fig 11. Third order intermodulation distortion as a function of average output power; typical values

8. Package outline

Flanged LDMOST ceramic package; 2 mounting holes; 4 leads

SOT1121A

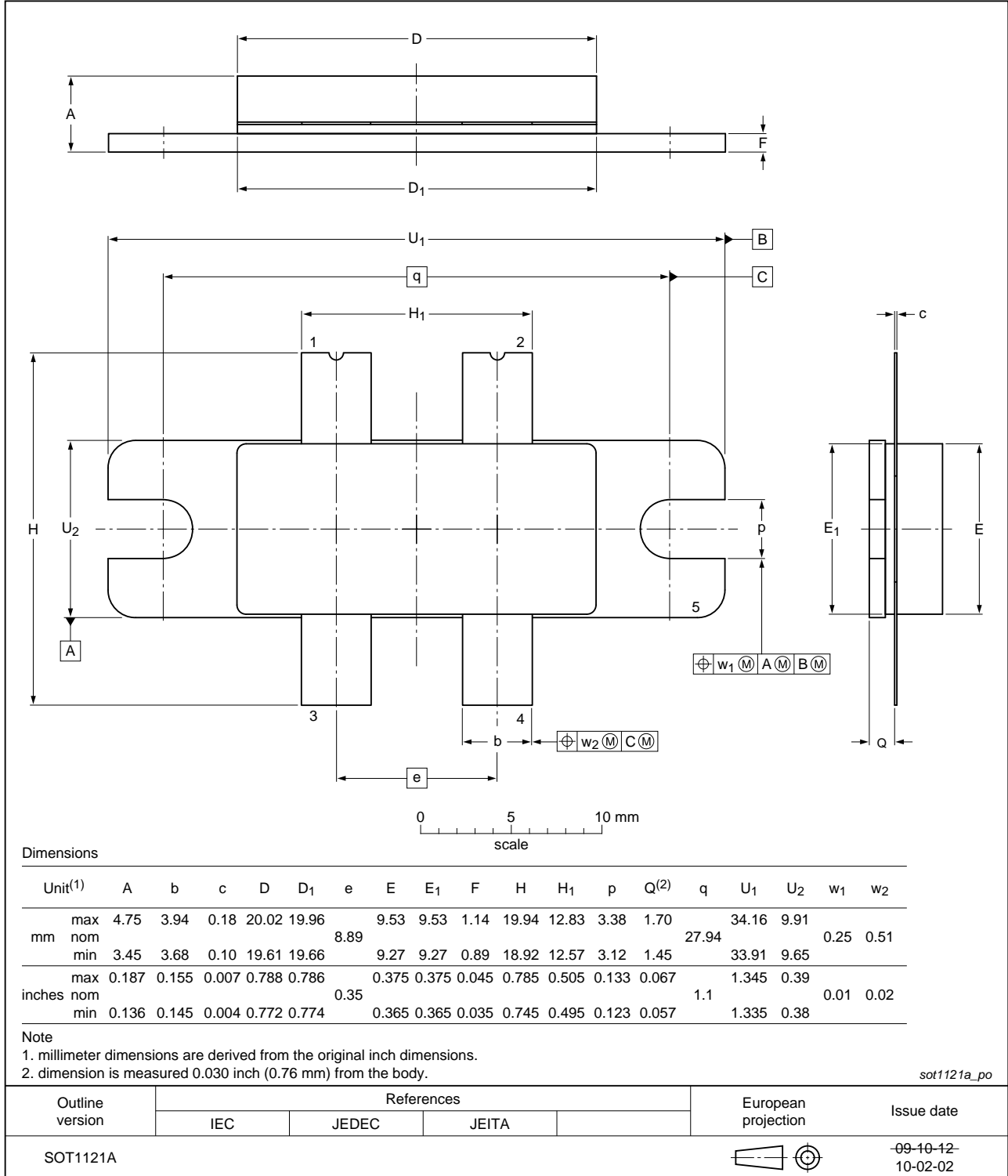


Fig 12. Package outline SOT1121A

9. Handling information

CAUTION



This device is sensitive to ElectroStatic Discharge (ESD). Observe precautions for handling electrostatic sensitive devices.

Such precautions are described in the *ANSI/ESD S20.20*, *IEC/ST 61340-5*, *JESD625-A* or equivalent standards.

10. Abbreviations

Table 10. Abbreviations

Acronym	Description
CW	Continuous Waveform
ESD	ElectroStatic Discharge
HF	High Frequency
LDMOS	Laterally Diffused Metal Oxide Semiconductor
LDMOST	Laterally Diffused Metal-Oxide Semiconductor Transistor
VSWR	Voltage Standing-Wave Ratio

11. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLF647P v.2	20130412	Product data sheet	-	BLF647P_BLF647PS v.1
Modifications:	<ul style="list-style-type: none"> This document now only describes the BLF647P product. Table 1 on page 1: table has been updated Section 1.2 on page 1: some items have been removed Table 4 on page 2: table has been updated Table 5 on page 2: typical value has been changed to 0.34 Table 6 on page 3: table has been updated Table 8 on page 3: table has been updated Section 7 on page 3: section has been added Section 7.1 on page 3: section has been moved to Section 7 Section 9 on page 11: section has been added 			
BLF647P_BLF647PS v.1	20120803	Objective data sheet	-	-

12. Legal information

12.1 Data sheet status

Document status ^{[1][2]}	Product status ^[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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